MASTER OF SCIENCE
IN
SOFTWARE ENGINEERING

NAVAL ARCHITECTURE ENVIRONMENT: FACILITATING JV2010

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This thesis demonstrates that the Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) Framework Version 2.0 requirements can be satisfied with one modern object oriented CASE tool. It provides an alternative scenario-centric approach to architecture development. The combination of scenarios and Unified Modeling Language (UML) semantics is referred to as the Naval Architecture Environment (NAE). Specifically, it recommended the acquisition of Rational Rose.

The NAE combines the best practices of software development with the domain-specific insight contained in the Framework to create an efficient process, supported by a commercial tool and robust semantics, to allow the analysis and design of interoperable C4ISR systems. These are systems that will support Joint Vision 2010's call for Information Superiority.

DoD KEY TECHNOLOGY AREA: Command, Control, and Communications

KEYWORDS: C4ISR, Architecture, Unified Modeling Language (UML)

COMMAND AND CONTROL DATA DISSEMINATION USING IP MULTICAST

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Tools have been developed which allow tactical data to be exchanged over Internet Protocol networks, but the quality of service necessary to operate these tools is not available for most Naval vessels at this time. The objective of this thesis is to show that using Multicast IP, distributing data in layers using an efficient protocol, and sending data with no inherent mechanism to ensure that packets arrive at their destinations will allow data to be exchanged over IP networks at much lower bandwidths than is required today while still maintaining a common tactical picture. Software was developed which interfaces to GCCS-M and exchanges data over a multicast network. This software was tested in a laboratory which simulated a Naval environment. The results of testing demonstrate the potential of using the characteristics of the track data being exchanged in a true multicast architecture to develop a efficient tactical data distribution system for users operating in the Naval environment.

DoD KEY TECNOLOGY AREAS: Command, Control and Communications, Computing and Software

KEYWORDS: Multicast, Command, Control, Communications, Common Operational Picture

DESIGN OF A PERSISTENCE SERVER FOR THE RELATIONAL HYPERGRAPH MODEL

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The fundamental purpose of this research is to develop an automated software evolution tool, CASES, for large and complex systems. CASES (Computer-Aided Software Evolution System) is based on the Relational Hypergraph model that is a formal model for describing software evolution processes. This model provides the preliminary mathematical definitions to support the development of CASES. There are five basic functions related to software evolution steps: step refinement, project evaluation, constraint management, personnel management, and step management. There are also five functions related to software evolution components: component management, component traceability, version control and configuration management, dependency management, and inference rule management. CASES is implemented by using Java JDK 1.1.7 and Swing 1.0.3 under the Visual Café version 3.0 environment. The primary contributions of this research include: (1) providing an automated tool for software evolution; (2) validating a software evolution model, the RH model; (3) allowing reuse of software evolution components; (4) describing the software evolution processes; (5) automating the version control of software evolution objects; (6) tracing the software evolution activities; and (7) managing and controlling job scheduling and assignment.

DoD KEY TECHNOLOGY AREA: Computing and Software

KEYWORDS: Software Evolution, Computer-Aided Software Evolution System (CASES)

DEVELOPMENT OF A QUALITY MANAGEMENT METRIC (QMM) MEASURING SOFTWARE PROGRAM MANAGEMENT QUALITY

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The quality of software management in a development program is a major factor in determining the success of a program. The four main areas where a software program manager can affect the outcome of a program are requirements management, estimation/planning management, people management, and risk management. By using current researched practices, interviews with senior program managers, and focus group data, the thesis examines the four areas for practices and structure that a software program manager may implement to positively affect the program. The thesis develops a Quality Management Metric (QMM) to measure the performance of the software manager. The QMM score is determined via a survey consisting of a two-part questionnaire for each of the four main areas examined. The thesis evaluated three software programs for a QMM score. Informal verification and validation of the metric compared the QMM percentile score to an overall program success score for the entire program and yielded positive correlation. The establishment of this methodology to quantify the quality of software management is an important step in evaluation of how past and current programs are managed and can serve as a template to improve software management performance in the future.

DoD KEY TECHNOLOGY AREA: Computing and Software

KEYWORDS: Software Management, Requirements Management, Estimation/Planning Management, Risk Management, Quality Management Metric (QMM)

RISK ASSESSMENT IN INCREMENTAL SOFTWARE DEVELOPMENT

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Cost overruns, schedule slips, and projects with fewer features or functions than originally specified are some of the difficulties that the software community faces in almost all software projects. The application of proper risk management throughout the lifecycle of the software development can drastically improve the chances of success. Risk management is an essential skill that many good mangers possess. Utilizing proper risk management provides early risk detection, which in turn gives the manager more flexibility to mitigate and resolve the risks within the software development project.

This thesis presents a disciplined and systematic risk management tool that can be utilized to assess risk in incremental software development projects from cradle to grave. This methodology can be applied with limited resources, and is adaptable and flexible enough to be used on all software intensive projects. The methodology incorporates the Software Engineering Institute's proven risk taxonomy and questionnaire. It also provides a project manager or project decision-maker an efficient way of assessing risk in incremental software development. Further, this thesis implements the risk assessment framework on a software development project and validates the validity and usefulness as a risk management tool.

DoD KEY TECHNOLOGY AREA: Computing and Software

KEYWORDS: Software Engineering, Risk Management, Systematic Risk Assessment Tool